

=> d his

(FILE 'HOME' ENTERED AT 14:37:42 ON 07 OCT 2002)

FILE 'CA' ENTERED AT 14:37:53 ON 07 OCT 2002

L1 68540 S CHARGE(2A)TRANSFER?  
L2 1071 S L1 AND(SENSOR OR DETECTOR OR(SENSING OR SENSITIVE OR ANALYSIS OR  
DETECTING OR DETECTION OR TEST) (4A) (MEMBRANE OR ELEMENT OR FILM OR  
LAYER))  
L3 29470 S (CONDUCTIVE OR CONDUCTING OR DOPED OR DOPING OR DOPANT) (5A)  
(POLYMER? OR COPOLYMER?)  
L4 875 S L1 AND L3  
L5 269222 S CARBON BLACK OR GRAPHITE OR PARAPHENYLENE? OR P PHENYLENE? OR  
TETRACYANO? OR CYANOQUIN? OR TETRATHIOFUL? OR THIOFULVALENE  
L6 6626 S L5 AND(SENSOR OR DETECTOR OR(SENSING OR SENSITIVE OR ANALYSIS OR  
DETECTING OR DETECTION OR TEST) (4A) (MEMBRANE OR ELEMENT OR FILM OR  
LAYER))  
L7 4114 S L5 AND L3  
L8 12328 S L2,L4,L6-7  
L9 9394 S L8 NOT PY>1998  
L10 1963 S L9 AND(ELECTRODE OR ELECTROCHEM? OR MICROELECTRODE OR NANOELECTRODE)  
L11 1379 S L8 NOT L9 AND PATENT/DT  
L12 412 S L11 AND(ELECTRODE OR ELECTROCHEM? OR MICROELECTRODE OR  
NANOELECTRODE)  
L13 2375 S L10,L12  
L14 386 S L13 AND(VAPOR? OR VOLATILE OR GAS? OR SEMIVOLATILE OR ELECTROACT?)

=> d l14 bib,ab 1-386

L14 ANSWER 109 OF 386 CA COPYRIGHT 2002 ACS  
AN 126:337986 CA  
TI Nernstian and non-Nernstian potentiometry  
AU Janata, Jiri; Josowicz, Mira  
CS Pacific Northwest National Laboratory, Richland, WA, USA  
SO Solid State Ionics (1997), 94(1-4), 209-215  
AB A review with 26 refs. It is possible to perform a potentiometric  
measurement in the **gas** phase in such a way that the formation of **charge  
transfer** complex between the **gaseous** species and semiconducting **electrode**  
results in chem. modulation of the Fermi level. In such a case the  
functional relationship is a generalized form of the Nernst equation in  
which the slope of the dependence of measured potential on partial pressure  
of **gas** assumes fractional values. It is shown that an entire new class of  
solid state **gas sensors** can be based on this principle.

L14 ANSWER 158 OF 386 CA COPYRIGHT 2002 ACS  
AN 121:256740 CA  
TI Optical absorption, luminescence, and redox switching properties of  
polyphenylene derivatives  
AU Reynolds, John R.; Child, Andrew D.; Ruiz, Jose P.; Musfeldt, Janice L.;  
Sankaran, Bala; Larmat, Fernando; Balanda, Peter; Tanner, David B.  
CS Cent. Macromol. Sci. Eng., Univ. Florida, Gainesville, FL, 32611, USA  
SO Materials Research Society Symposium Proceedings (1994), 328(Electrical,  
Optical, and Magnetic Properties of Organic Solid State Materials), 191-5  
AB A series of polyphenylene deriv. polymers with a variety of heterocyclic  
units along the main chain, and various pendant groups, have been  
synthesized and their optoelectrochem. properties examd. Polyphenylenes  
contg. electronically isolated emitter centers have optical absorption and  
luminescence characteristics which are a function of the length of the  
conjugated unit. A water sol. **electroactive** rigid-rod poly(**p-phenylene**),

specifically poly[2,5-bis(propoxy-3-sulfonate)-1,4-phenylene-alt-1,4-phenylene], has been prepd. Soln. cast films of this polymer exhibit optical evidence for bipolarons via both p-type and n-type **electrochem.** doping. Further poly(**p-phenylene**) (PPP) derivs. are being pursued, including PPP's bearing pendant donor mols. for **charge transfer** complex formation. A series of polymers contg. alternating **p-phenylene** units with bithienylene and bifuranylene units, specifically poly[1,4-bis(2-heterocycle)-2,5-disubstituted-1,4-phenylenes], have been synthesized with both alkyl alkoxy pendant groups. Steric interactions disrupt the ability of the redox **doped polymers** to attain planarity, strongly affecting the polymer's oxidn. potentials and DC conductivities. The substituent length has little effect on the electronic properties of the polymer, but greatly affects the polymer's soly. and transport properties during redox switching.

L14 ANSWER 162 OF 386 CA COPYRIGHT 2002 ACS

AN 121:206817 CA

TI Electrically conductive composite of polypyrrole and liquid crystalline aromatic copolyamide

AU Bao, Jingsheng; Xu, C. C.; Cai, W.; Bi, Xiantong

CS Inst. Chem., Acad. Sin., Beijing, 100080, Peop. Rep. China

SO Materials Research Society Symposium Proceedings (1992), 247(Electrical, Optical, and Magnetic Properties of Organic Solid State Materials), 699-704

AB The modification of the mech. properties of polypyrrole (PPy) by **electrochem.** prepn. of **conductive** composite film from pyrrole (Py) **polymd.** in the matrix of two kinds of liq. cryst. copolyamides, i.e., 4,4'-diaminodiphenylmethane-**p-phenylenediamine**-terephthaloyl chloride copolymer (PPTA[C]) and 4,4'-diaminodiphenyl ether-**p-phenylenediamine**-terephthaloyl chloride copolymer (PPTA[O]) is presented. The elec. cond. of the PPTA[O]/PPy and PPTA[C]/PPy composites are the same order of magnitude as PPy. The mech. properties of the composite films are better than that of pure PPy and the composite films have good **electroactivity** and thermal stability.

L14 ANSWER 166 OF 386 CA COPYRIGHT 2002 ACS

AN 121:67921 CA

TI Factors affecting background permeabilities of ordered mono-, bi- and multilayers as channel mimetic **sensing membranes**

AU Sugawara, Masao; Khoo, Soo Beng; Yoshiyagawa, Shinji; Yagi, Kenichi; Sato, Hitoshi; Namba, Madoka; Wakabayashi, Mari; Minami, Hirotsugu; Sazawa, Hiroyuki; et al.

CS Sch. Sci., Univ. Tokyo, Tokyo, 113, Japan

SO Analytical Sciences (1994), 10(2), 343-7

AB Channel mimetic **sensing membranes**, which display a chem. **sensing** function based on analyte-induced changes in the permeability through ordered membranes, give a promising approach to the development of a novel class of chem. **sensors**. For the design of channel mimetic **membranes** capable of **sensing** based on guest (analyte)-induced changes in the membrane permeability for **electroactive** markers, the control of the background permeability is an important factor to attain max. permeability changes. In the case of a guest-induced increase (decrease) in the membrane permeability, the magnitude of changes in the membrane permeability will be greatly affected by the degree of suppression (facilitation) of membrane permeability in the absence of guests. Such a background permeability will be affected by the nature of the membranes as well as that of the permeability markers. The authors report results of cyclic voltammetry (CV) and membrane conductance measurements that show the effect of the compn. of membranes and of the nature of permeability markers (charge,

steric bulkiness, hydrophobicity) on the background membrane permeabilities. Different types of the ordered membrane assemblies, i.e., receptor-incorporated charged membranes, uncharged receptor membranes and receptor-incorporated planar bilayer lipid membranes (BLMs), were examd.

L14 ANSWER 179 OF 386 CA COPYRIGHT 2002 ACS

AN 119:190719 CA

TI Studies on reactions proceeding at the interface between **conducting polymer** and redox electrolyte

AU Maksymiuk, K.; Doblhofer, K.

CS Fritz-Haber-Inst., Max-Planck-Ges., Berlin, D-1000/33, Germany

SO Synthetic Metals (1993), 55(2-3), 1382-7

AB The kinetics and mechanism of **electrochem.** reactions of cationic  $\text{Fe}^{3+}/\text{Fe}^{2+}$  and anionic  $\text{Fe}(\text{CN})_6^{3-}/\text{Fe}(\text{CN})_6^{4-}$  redox couples were studied at glassy C (GC) **electrodes** covered (i) by poly-N-methylpyrrole (PMPy) with perchlorate mobile counter anions and (ii) by poly-N-methylpyrrole with immobilized poly-4-styrenesulfonate anions (PMPy/PSS) exhibiting properties of a cation exchange membrane. The results obtained are analyzed from a model, in which the **charge transfer** is regarded as a chem. redox reaction between **electroactive** species in soln. and the oxidized or reduced sites of the **conducting polymer**. The influence of Donnan potential on kinetics of such **charge transfer** reactions is demonstrated.

L14 ANSWER 186 OF 386 CA COPYRIGHT 2002 ACS

AN 118:255696 CA

TI Voltammetric characterization of soluble polyacetylene derivatives obtained from the ring-opening metathesis polymerization (ROMP) of substituted cyclooctatetraenes

AU Jozefiak, Thomas H.; Ginsburg, Eric J.; Gorman, Christopher B.; Grubbs, Robert H.; Lewis, Nathan S.

CS Arnold and Mabel Beckman Lab. Chem. Synth., California Inst. Technol., Pasadena, CA, 91125, USA

SO Journal of the American Chemical Society (1993), 115(11), 4705-13

AB High-mol.-wt., amorphous, partially substituted polyacetylenes are prep'd. by the ring-opening metathesis polymn. of substituted cyclooctatetraenes. Spin-cast films of these polymers yield unusually sharp, well-defined, reversible **electrochem.** for oxidative and reductive doping processes. As the substituent R on the polymer chain is varied (R = alkyl, tert-BuO, Me<sub>3</sub>Si, and p-X-C<sub>6</sub>H<sub>4</sub>), the potentials for oxidative and reductive doping changes by 0.3 V. In addn., the sepn. between the oxidative and reductive doping processes varies from 1.66 to >2.0 V. Coulometry suggests that the reversible doping step represents a transfer of 1 electron for every 13-15 double bonds of the polymer. In contrast, the **electrochem.** of predominantly cis polymer films is irreversible, and indicates the presence of an **electrochem.** cis-trans isomerization on the 1st voltammetric sweep through either reductive or oxidative doping. Spectroelectrochem. studies indicate that the **electrochem.** doped substituted polyacetylenes (R = sec-Bu, Me<sub>3</sub>Si) possess mid-gap transitions at energies of 0.8-0.9 eV. Voltammetry of the sol. substituted polyacetylenes shows that both the reductive and oxidative doping processes are chem. irreversible, and indicates that the dissolved polymers are **electroactive** over a wide range of potentials.

L14 ANSWER 197 OF 386 CA COPYRIGHT 2002 ACS

AN 117:253970 CA

TI **Electrochemical sensors** based on polyconjugated **conducting polymers**

AU Zotti, G.

CS Ist. Polarogr. Elettrochim. Preparat., Padua, 35020, Italy

- SO Synthetic Metals (1992), 51(1-3), 373-82  
AB A review, with 53 refs., of the applications of polyconjugated **conducting polymers** to **electrochem. sensors** in terms of **gas sensors**, ion sensors, and biosensors. The role of the polymer as enzyme host and mediator of **charge transfer** was emphasized.
- L14 ANSWER 211 OF 386 CA COPYRIGHT 2002 ACS  
AN 115:192256 CA  
TI **Electroactive** bilayers employing **conducting polymers**. 2. Speciation by in situ spectroscopy  
AU Hillman, A. Robert; Mallen, Elizabeth F.  
CS Sch. Chem., Univ. Bristol, Bristol, BS8 1TS, UK  
SO J. Chem. Soc., Faraday Trans. (1991), 87(14), 2209-17  
AB **Electrochem.** driven charge trapping and untrapping reactions in poly(bithiophene)poly(xylylviologen) (PBT/PXV) bilayers were studied using in-situ transmission spectroscopy in the visible region. **Charge transfer** to the outer film is exclusively mediated by the conducting states of the inner film. The redox compn. of the outer film was detd. as a function of potential and injected charge in cyclic voltammetric expts. During redn. of the outer film, the semi-reduced PXV<sup>+</sup> species is the predominant product until essentially all the reactant PXV<sup>2+</sup> is consumed. Prodn. of fully reduced PXV<sup>0</sup> depends on film thickness and voltage scan rate. Similarly, PXV<sup>+</sup> is the predominant product of PBT<sup>+</sup>-mediated PXV<sup>0</sup> oxidn., until PXV<sup>0</sup> consumption is almost complete. Slow changes in the outer-film compn. due to reaction with trace oxidant (presumed to be O) in soln. were detected.
- L14. ANSWER 224 OF 386 CA COPYRIGHT 2002 ACS  
AN 113:240003 CA  
TI Stochastic property in the propagation of a **conductive** zone in **electroactive conducting polymers**  
AU Aoki, Koichi  
CS Fac. Eng., Fukui Univ., Fukui, 910, Japan  
SO J. Electroanal. Chem. Interfacial Electrochem. (1990), 292(1-2), 53-62  
AB **Electrochem.** switching of **doping** and undoping states in **conductive polymer** films provides a non-uniform concn. distribution of the conductive species. The distribution was evaluated from the propagation model of a conductive zone under **charge transfer** control when the **charge transfer** by linear sweep voltammetry was totally irreversible, quasi-reversible and reversible. The totally irreversible **charge transfer** leads to a conductive zone localized to the substrate **electrode**, whereas the reversible one yields an apparent uniform concn. profile. These results were based on the requirement that all the conductive segments were connected elec. to the substrate through the other conductive segments. The theory was also treated as a stochastic process, in which the Nernst equation on the substrate **electrode** was presented by the probability of the presence of the conductive species. The concn. of the conductive species was replaced by the probability of the av. length of 1-dimensional conductive pillars. The stochastic process was carried out by the Monte Carlo simulation, indicating that the conductive phase was stable for the irreversible case and unstable for the reversible case.
- L14 ANSWER 227 OF 386 CA COPYRIGHT 2002 ACS  
AN 113:161198 CA  
TI Modified composite **electrodes** with renewable surface for **electrochemical** applications and method of making same  
IN Shaw, Brenda R.; Creasy, Kenneth E.  
PA University of Connecticut, USA  
SO U.S., 4 pp.

PI US 4933062 A 19900612 US 1989-320233 19890307  
 AB Renewable modified composite **electrodes** for **electrochem.** application are provided by a homogeneous structure of a **conductive** filler disposed in a **polymeric** matrix or binder contg. a modifier in the polymer chain. The modifier provides **electroactivity**, inclusion, acidic/basic, complexing/chelating, or electrocatalysis properties to the surface of the **electrode** in soln. After use, the **electrode** may be renewed by removing a surface portion to expose a fresh portion. **Electrodes** are formed from styrene, divinylbenzene, vinylferrocene, 2,2'-azobis(2-methylpropionitrile, and C black.

L14 ANSWER 236 OF 386 CA COPYRIGHT 2002 ACS  
 AN 111:245358 CA  
 TI Morphology of **paraphenylenediamine**-aniline **conducting copolymers**  
 AU Mailhe-Randolph, C.; McEvoy, A. J.  
 CS Inst. Chim. Phys., Ec. Polytech. Fed. Lausanne, Lausanne, CH-1015, Switz.  
 SO Ber. Bunsen-Ges. Phys. Chem. (1989), 93(8), 905-8  
 AB Electrooxidn. of aniline on conductive substrates, in an aq. chloride electrolyte at low pH, produces adherent polyaniline (PANI) films. In the initial stage of polymn. the films exhibit a uniform globular microstructure which evolves to a fibrous deposit for thicker films. Although **p-phenylenediamine** (PPDA) itself does not electropolymerize to give a well defined **electroactive** film, in small admixts. it can modify dramatically the morphol. of the copolymer with aniline. PPDA evidently promoted nucleation and crosslinking during the electropolymn. **Electrochem.** characteristics and SEM micrographs of the doped PANI films are presented.

L14 ANSWER 237 OF 386 CA COPYRIGHT 2002 ACS  
 AN 111:195533 CA  
 TI Aqueous **electrochemistry** of polyacetylene (CH)<sub>x</sub> and poly(**p-phenylene**)  
 AU MacDiarmid, A. G.  
 CS Dep. Chem., Univ. Pennsylvania, Philadelphia, PA, USA  
 SO Report (1988), Order No. AD-A201461, 21 pp. Avail.: NTIS From: Gov. Rep. Announce. Index (U. S.) 1989, 89(8), Abstr. No. 918,133  
 AB Polyacetylene (I) and polyaniline, two completely different types of **conducting polymers**, i.e., org. **polymers** which upon **doping** exhibit the elec., electronic, and magnetic properties of metals while retaining the mech. and related properties characteristic of conventional polymers, were investigated. Studies included the synthesis, doping, **electrochem.** and selected phys. properties of these materials. I chains in the trans configuration lie parallel to the fibril axis and the elec. and optical properties are consistent with the principal  $\pi$  elec. transport occurring along the (CH)<sub>x</sub> chains. I can be epitaxially polyemd. from the **gas** phase on single crystal faces of biphenyl which were coated with a very thin layer of catalyst.

L14 ANSWER 268 OF 386 CA COPYRIGHT 2002 ACS  
 AN 107:85921 CA  
 TI **Electrochemical** and resonance Raman spectroscopic characterization of polyaniline and polyaniline-metalloporphyrin **electrode** films  
 AU Macor, Kathleen A.; Su, Y. Oliver; Miller, Lisa A.; Spiro, Thomas G.  
 CS Dep. Chem., Princeton Univ., Princeton, NJ, 08544, USA  
 SO Inorg. Chem. (1987), 26(16), 2594-8  
 AB Characteristics of electropolyemd. PhNH<sub>2</sub> and metallotetrakis(2-aminophenyl)porphine (metallo-2-TAPP) films are described. Aniline polyemd. from methylene chloride soln. by oxidative cycling at a Pt **electrode** shows characteristic 1-wave or 2-wave cyclic voltammograms (CV) when scanned in pH 1 aq. soln., depending on the pos. potential sweep limit. Similar CV's

are produced when the soln. contains metallo-TAPP's, except that addnl. waves assocd. with metalloporphyrin redox processes are superimposed. The absorption spectra of the films formed on transparent SnO<sub>2</sub> **electrodes** showed characteristic metalloporphyrin Soret absorption bands, with red shifts relative to the soln. spectra, due to axial coordination and/or excitonic effects. Raman spectra are reported for films polymd. from PhNH<sub>2</sub>, aniline-15N, aniline-N,N-d<sub>2</sub>, and aniline-d<sub>5</sub>. The replacement of strong PhNH<sub>2</sub> bands at 1000 and 1029 cm<sup>-1</sup> with bands in the films at 1190 and 1200 cm<sup>-1</sup> is diagnostic for para-substituted PhNH<sub>2</sub> units in the polymer. The **films** show a strong 15N-sensitive band at 1525 cm<sup>-1</sup>, which is absent in PhNH<sub>2</sub> but present in **p-phenylenediamine**. It was assigned to a Fermi resonance between a Ph ring mode and a combination mode involving an out-of-plane ring motion with substantial N involvement. This band also appears in the TAPP films, superimposed on the strong resonance Raman spectra of the metalloporphyrins. Thus the **electrochem.** and spectroscopic characteristics of the TAPP films are fully consistent with unmodified porphyrin units contained within a polyaniline polymer. No film formation was obsd. when a methylene chloride soln. of Zn(2-TAPP) is cycled to 0.9 V, just beyond the porphyrin radical cation oxidn. wave, but extending the sweep to 1.2 V does lead to polymer formation. Thus, porphyrin radical cation formation is insufficient to induce polymn. if the potential is lower than that required for oxidn. of PhNH<sub>2</sub>. Films Mn(2-TAPP) show a Mn<sup>3+/2+</sup> wave at ~-0.2 V, neg. of the polyaniline redox waves, when the **electrode** is in contact with nonaq. or aq. electrolyte. The metalloporphyrin redox process does not require electronic conduction through the polyaniline framework. When polyaniline or polyaniline-porphyrin films are scanned to pos. potentials (1.4 V) in contact with aq. electrolyte, **electroactivity** is abolished both for the PhNH<sub>2</sub> and metalloporphyrin redox waves.

L14 **ANSWER 269 OF 386** CA COPYRIGHT 2002 ACS

AN 107:80975 CA

TI Electrically conductive material and secondary battery using the electrically conductive material

IN Suzuki, Tetsumi; Hasegawa, Kazumi; Furukawa, Nobuhiro; Nishio, Koji; Fujimoto, Masahisa; Yoshinaga, Noriyuki

PA Sanyo Electric Co., Ltd., Japan; Mitsubishi Chemical Industries Co., Ltd.

SO Eur. Pat. Appl., 79 pp.

PI EP 219063 A2 19870422 EP 1986-113998 19861009

US 4731311 A 19880315 US 1986-917051 19861009

PRAI JP 1985-225761 19851009

AB An elec. conductive material contains no substantial amt. of water and is prepd. by polyimg. in the presence of an oxidizer a compd. having conjugated double bonds (pyrrole or thiophene) on a hydrophobic resin or inorg. base having spaces capable of retaining the oxidizer. The hydrophobic resin is polyethylene, polypropylene, C<sub>2</sub>H<sub>4</sub>-C<sub>3</sub>H<sub>6</sub> copolymer, PVC, PTFE, etc. The inorg. base material is active C, **carbon black**, **graphite**, Cr, stainless steel, K<sub>2</sub>TiO<sub>3</sub>, SiC, etc. The elec. conductive material is used for ≥1 **electrode** of a secondary battery. Porous 10 × 20 cm × 20-μ polyethylene films having a pore size of 0.1-10μ and a water content of 0.04% were immersed into a satd. soln. of FeCl<sub>3</sub>·6H<sub>2</sub>O in MeOH at ~20° for 30 min, dried in air, and placed in contact with pyrrole **vapor**. The films rapidly changed from yellow through dark green to black while polypyrrole was formed on the films. The films were removed after 0.5-, 2.0-, or 21-h contact time and immersed into MeOH for 30 min to remove unreacted pyrrole and FeCl<sub>3</sub>. This procedure was repeated 3 times, followed by drying in air. The resp. thickness and elec. cond. of the films were 22, 24, and 42μ and 0.28, 0.52, and 0.26 s/cm. The use of similarly prepd. film as anode in an

org.-electrolyte Li battery is also reported.

L14 ANSWER 280 OF 386 CA COPYRIGHT 2002 ACS

AN 104:218316 CA

TI **Gas sensors**

IN Kita, Hidetoshi; Kato, Yoshinao

PA Nissin Electric Co., Ltd., Japan

SO Jpn. Kokai Tokkyo Koho, 4 pp.

PI JP 61003039 A2 19860109 JP 1984-123976 19840616

AB Diene type polymers having the structural repeating units of C<sub>6</sub>H<sub>4</sub>, arylene, 1,6-heptadiyne, or substituted phenylene are placed between a pair of **electrodes** to give a **gas sensor** which detects **gas** by the resistance change between the **electrodes**. The **elements** are useful in **detecting** decompn. **gases**. Thus, Au **electrodes** were evapd. on a poly(**p-phenylene**) film, prepd. by sintering a formed body at 400°, to give a **gas sensor**, which was placed in a circuit breaker to show resistance of  $3 \times 10^{11} \Omega$ . The **sensor** showed resistance of  $5 \times 10^6 \Omega$  towards 1.2% SO<sub>2</sub>F<sub>2</sub> and 0.2% SOF<sub>2</sub>.

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STN INTERNATIONAL LOGOFF AT 14:56:22 ON 07 OCT 2002

=> d his

(FILE 'HOME' ENTERED AT 14:49:22 ON 08 OCT 2002)

FILE 'REGISTRY' ENTERED AT 14:49:58 ON 08 OCT 2002

L1 1 S 25038-69-1

L2 5 S 25067-58-7 OR 25233-30-1 OR 25233-34-5 OR 30604-81-0 OR 72945-66-5  
SEL NAME L2

L3 5213 S POLYACETYLENE OR POLYPYRROLE OR POLYTHIOPHENE OR POLYANILINE OR  
POLYMETHYLPYRROLE OR POLY(1A) (PYRROLE OR ANILINE OR THIOPHENE OR  
ACETYLENE OR METHYLPYRROLE)

FILE 'CA' ENTERED AT 14:54:25 ON 08 OCT 2002

L4 55888 S L1-3 OR E1-33

L5 31694 S POLYACETYLENE OR POLYPYRROLE OR POLYTHIOPHENE OR POLYANILINE OR  
POLYMETHYLPYRROLE OR POLY(1A) (PYRROLE OR ANILINE OR THIOPHENE OR  
ACETYLENE OR METHYLPYRROLE)

L6 56170 S L4-5

L7 43900 S L6 NOT PY>1998

L8 3976 S L6 NOT L7 AND PATENT/DT

L9 47876 S L7-8

L10 1738 S L9 AND (SENSOR OR DETECTOR OR (SENSING OR SENSITIVE OR DETECTION OR  
DETECTING OR ANALYSIS) (4A) (FILM OR MEMBRANE OR LAYER OR ELEMENT))

L11 2314 S (L1-3 OR E1-33) (5A) COMPOSITE

L12 1830 S L9 AND L11

L13 1534 S L10 NOT ENZYM?

L14 89 S L13 AND L11

L15 682 S L13 AND (CONDUCT? OR ELECTROCONDUCT? OR ELECTROACTIV?)

L16 178 S (CHARGE(1A) TRANSFER? OR CARBON BLACK OR GRAPHITE OR PARAPHENYLENE?  
OR P PHENYLENE? OR TETRACYANO? OR CYANOQUIN? OR TETRATHIAFUL? OR  
THIAFULVALENE) AND L15

L17 307 S (CHARGE(1A) TRANSFER? OR CARBON BLACK OR GRAPHITE OR PARAPHENYLENE?  
OR P PHENYLENE? OR TETRACYANO? OR CYANOQUIN? OR TETRATHIAFUL? OR  
THIAFULVALENE) AND L12

L18 118 S L17 AND (CONDUCT? OR ELECTROCONDUCT? OR ELECTROACTIV?)

L19 101 S L15 AND (BLEND OR COMPOSITE)

L20 356 S L15 AND SENSOR/TI, IT

L21 150 S L20 AND (GAS OR GASEOUS OR VAPOR? OR VOLATILE)

L22 520 S L14, L16, L18-19, L21

=> d 122 bib,ab 1-520

L22 ANSWER 58 OF 520 CA COPYRIGHT 2002 ACS

AN 131:146931 CA

TI **Composite** electrode, its manufacture, and secondary nonaqueous electrolyte lithium battery using it as cathode

IN Sotomura, Tadashi

PA Matsushita Electric Industrial Co., Ltd., Japan

SO Jpn. Kokai Tokkyo Koho, 9 pp.

PI JP 11214008 A2 19990806 JP 1998-15856 19980128

US 6245458 B1 20010612 US 1998-211779 19981215

PRAI JP 1998-15856 A 19980128

AB The title electrode contains an org. S compd. having  $\geq 1$  thiol(ate) group, **polyaniline**, and S. Preferably, the electrode has a support comprising Cu, Ag, Cu alloy, or Ag alloy at least on the surface or contains a compn. contg. powder of Cu, Ag, Cu alloy, or Ag alloy. The manufg. method involves the following steps: (1) dissolving the org. S compd. in N-R-2-pyrrolidone (R = H, alkyl), (2) adding **polyaniline** powder and then S powder, (3) applying the obtained slurry on a **conductive** support, and (4) heating in vacuum or in an inert gas atm. In the manufg. method, powder of Cu, Ag, Cu alloy, or Ag alloy may be added into the pyrrolidone soln. before the addn. of the **polyaniline** powder. Also claimed is the battery having the electrode as the cathode with high capacity and voltage and good cycling performance. The electrode is also useful for electrochromic devices, **sensors**, etc.

L22 ANSWER 68 OF 520 CA COPYRIGHT 2002 ACS

AN 131:27230 CA

TI Effect of micro-electrode geometry on response of thin-film **poly(pyrrole)** and **poly(aniline)** chemoresistive **sensors**

AU Ingleby, P.; Gardner, J. W.; Bartlett, P. N.

CS Department of Engineering, University of Warwick, Coventry, CV4 7AL, UK

SO Eurosensors XII, Proceedings of the 12th European Conference on Solid-State Transducers and the 9th UK Conference on Sensors and Their Applications, Southampton, UK, Sept. 13-16, 1998 (1998), Volume 1, 135-138. Editor(s): White, N. M. Publisher: Institute of Physics Publishing, Bristol, UK.

AB The response of four different electrochem.-prepd. **conducting** polymer **gas sensors** was studied. A theor. model is developed exploring the effect of the micro-electrode geometry on both the steady-state and transient response of these polymer **sensors**. The theory is compared with exptl. results obtained by exposing the **sensors** to various concns. of ethanol **vapor** in air at different temps. and relative humidity's.

L22 ANSWER 75 OF 520 CA COPYRIGHT 2002 ACS

AN 130:210057 CA

TI Surface and intergallery polymerization reactions of organic monomers on layered silicate hosts

AU Porter, Timothy L.; Hagerman, Michael E.; Eastman, Michael P.

CS Dept. of Physics and Astronomy, Northern Arizona University, Flagstaff, AZ, 86011, USA

SO Recent Research Developments in Polymer Science (1997), 1, 1-17

AB The nanometer-scale phys. and chem. topog. of polymer-layered silicate **composites** are important in the study and development of nanostructured materials including chem. **sensors**, photonic devices, and inorg.-org. **conductive** polymer assemblies. Cu(II)-exchanged hectorite thin films exhibit remarkable properties as inorg. hosts for the spontaneous polymn. of benzene, aniline, thiophene, and pyrrole. SFM images illustrate the large-scale polymn. of aniline, thiophene, and pyrrole occurs on the



surface of these films when exposed to the org. monomer **vapor**. ESR, EPR, and powder x-ray diffraction data show that polymn. of aniline occurs on the clay surface and in inter-gallery regions of the clay. The Cu(II) cations play a pivotal role in promoting the oxidn. of the org. guest monomers and the subsequent polymn. reactions. Using std. lift-off techniques or razor cleaving, the exposed intergallery **polyaniline** was successfully imaged using non-contact SFM in phase-contrast mode. The nearly two-dimensional polymer sheets formed in these regions exhibit none of the nanometer-scale grain or bundle structure commonly assocd. with **polyaniline** synthesized using techniques such as electrochem. or vacuum deposition. Using SFM phase contrast imaging, the in situ surface nucleation and growth of **polyaniline** on hectorite was also studied. A novel mechanism for the nucleation and growth of the surface polymer film is presented. The availability of surface Cu(II) cations via defects or faults in the layered silicate structure is crucial to the formation of the subsequent **conductive** polymer layer. The elec. response of the clay-**conducting** polymer **composites** was also studied for films fabricated on 15  $\mu\text{m}$  interdigitated arrays (IDA's). Preliminary results indicate that these **composite** materials may be highly suitable as chem. **sensors** for a variety of important **gases** and **vapors** such as ethanol and hexane.

L22 ANSWER 86 OF 520 CA COPYRIGHT 2002 ACS

AN 130:118818 CA

TI **Conducting** polymer based acid/base **sensors**

IN Jang, Guang-Way

PA Gumbs Associates, Inc., USA

SO U.S., 12 pp.

PI US 5869007 A 19990209 US 1996-704375 19960822

AB Acid/base measuring **sensor** systems consisting of arrays of basic **sensor** cells are described which are constructed based on the chem./elec. response characteristics of poly(arom. amines). Protonation (doping) or deprotonation (de-doping) of the --N:sites in the polymers leads to characteristic **cond.** vs. concn. curves which can be calibrated to produce reliable, instantaneous readings of the acid/base concns. at various points in the working environment.

L22 ANSWER 89 OF 520 CA COPYRIGHT 2002 ACS

AN 130:85749 CA

TI Use of an electronic nose to detect tainting compounds in raw and treated potable water

AU Stuetz, R. M.; White, M.; Fenner, R. A.

CS Water Engineering Research Group, University of Hertfordshire, Hatfield, AL10 9AB, UK

SO Aqua (Oxford) (1998), 47(5), 223-228

AB An electronic nose incorporating 12 **polypyrrole conducting** polymer **sensors** was used to detect tainting compds. in supply waters. Raw and treated water samples were tainted with geosmin, methylisoborneol, 2-chlorophenol, phenol, diesel fuel, and 2-chloro-6-methylphenol at various concns. Multiple discriminant anal. showed that no overlapping occurred between any of the tainted and untainted samples and that the taint concns. were sepd. into distinct clusters. Close grouping between repeated tests also indicated that the **sensor** responses were reproducible. The clear sepn. of the tainted and untainted water samples demonstrated that the nonspecific **sensor** array can distinguish between clean water and water that contains trace levels of org. pollutants. This suggests that tainting compds., and therefore changes to the tastes and odors of the water, could be detected by monitoring the headspace **gas** of a water supply.

L22 ANSWER 104 OF 520 CA COPYRIGHT 2002 ACS

AN 129:257206 CA

TI Application of urea **sensor** based on **composite** film of electropolymerized **polypyrrole** and polyion complex to flow injection analysis

AU Osaka, Tetsuya; Komaba, Shinichi; Seyama, Michiko; Fujino, Yusuke; Satoh, Ikuo

CS Dep. Appl. Chem., Sch. Sci. Eng., Kagami Mem. Lab. Mater. Sci. Technol., Waseda Univ., Shinjuku-ku, Tokyo, 169, Japan

SO Chemical Sensors (1997), 13(Suppl. A, Proceedings of the 24th Chemical Sensor Symposium, 1997), 137-140

AB We previously reported a series of potentiometric biosensors for urea based on a electropolymerized insulating **polypyrrole** (PPy). Among them, composite PPy with polyion complex (PIC) showed a high sensitivity for urea detn. In order to enable the fast and continuous anal., the PPy/PIC urea **sensor** was applied to a flow injection anal. (FIA) system. This **sensor** demonstrated 85 mV decade<sup>-1</sup> of sensitivity, and 12 samples h<sup>-1</sup> could be assayed. Furthermore, the effect of carrier buffer concn. and pH were investigated.

L22 ANSWER 107 OF 520 CA COPYRIGHT 2002 ACS

AN 129:241940 CA

TI Urea sensing by pH-stat system with **polypyrrole**/polyion complex **composite** film electrode

AU Komaba, Shinichi; Seyama, Michiko; Fujino, Yusuke; Osaka, Tetsuya

CS School of Science and Engineering, Waseda University, Tokyo, 169, Japan

SO Chemical Sensors (1997), 13(Suppl. B, Proceedings of the 25th Chemical Sensor Symposium, 1997), 57-60

AB Amperometric urea sensing system based on pH-stat was constructed with **polypyrrole**/polyion complex (PPy/PIC) **composite** film electrode, which demonstrated high sensitivity as potentiometric urea **sensor**. In this pH stat system, a generating electrode (G. E.), a nickel mesh anode, was positioned near the PPy/PIC electrode. In order to maintain const. pH around the PPy/PIC, electrolysis of water on the G. E. was controlled by potentiostat. And then, the near-linear relationship between the electrolysis current and urea concn. was obtained.

L22 ANSWER 113 OF 520 CA COPYRIGHT 2002 ACS

AN 129:156157 CA

TI **Conducting** polymers doped with metallic inclusions: new materials for **gas sensors**

AU Torsi, L.; Pezzuto, M.; Siciliano, P.; Rella, R.; Sabbatini, L.; Valli, L.; Zambonin, P. G.

CS Dipartimento di Chimica, Universita'degli Studi di Bari 4, Bari, I-70216, Italy

SO Sensors and Actuators, B: Chemical (1998), B48(1-3), 362-367

AB Electrochem. synthesized **conducting** polymers, such as **polypyrrole** and poly-3-methylthiophene, were doped with copper and palladium inclusions. These metals are deposited potentiostatically either on the pristine **conducting** films or on the partially reduced samples. **Gas sensor** devices based on these doped org. **films** show interesting performances in **detecting** reducing **gases** such as NH<sub>3</sub>, H<sub>2</sub> and CO.

L22 ANSWER 116 OF 520 CA COPYRIGHT 2002 ACS

AN 129:138468 CA

TI Charge-discharge properties of **composite** films of **polyaniline** and crystalline V2O5 particles

AU Kuwabata, Susumu; Idzu, Tetsuo; Martin, Charles R.; Yoneyama, Hiroshi

CS Department of Applied Chemistry, Faculty of Engineering, Osaka University, Osaka, 565-0871, Japan

SO Journal of the Electrochemical Society (1998), 145(8), 2707-2710  
AB **Composites** of **polyaniline** and V2O5 were prepd. by casting on a Ni electrode substrate an N-methylpyrrolidinone soln. contg. dissolved **polyaniline** in its reduced state and dispersed cryst. V2O5 powder. Charge-discharge tests of the as-prepd. **composites** showed that redox reactions of both **polyaniline** and V2O5 particles took place, and a utilization of V2O5 higher than 0.9 was obtained, indicating that **polyaniline** worked not only as an active material but also as a **conducting** matrix for V2O5 particles. The effects of charge-discharge current densities, the amt. of V2O5 in the **composite** films, and the film thickness on the charge-discharge properties were investigated in detail. Elemental **analyses** of the **composite** films revealed that Li<sup>+</sup> was the primary participant involved in the charge-discharge reactions of the **composites**, suggesting that V2O5 particles were neg. charged during the course of prepn. of the **composites** and served as charge compensators for pos. charges generated on the **polyaniline** in its oxidized state.

L22 **ANSWER 136 OF 520** CA COPYRIGHT 2002 ACS

AN 128:263150 CA

TI Electrocatalytic oxidation of some biologically important compounds at conducting polymer electrodes modified by metal complexes

AU Galal, Ahmed

CS Dep. Chemistry, Faculty Science, Univ. Cairo, Giza, Egypt

SO Journal of Solid State Electrochemistry (1998), 2(1), 7-15

AB Conducting poly(3-methylthiophene) electrodes were electrochem. prepd. The resulting polymer films were modified with an inorg. complex, ferrocene. The incorporation of the ferrocene/ferrocenium moiety into the polymer film resulted in enhanced **charge transfer** towards the oxidn. of some org. mols. of biol. interest. The electrochem. response of the complex-contg. polymer electrode was compared to that of the unmodified polymer electrode and that of the substrate. Apparent diffusion coeffs. of the redox species were estd. from the cyclic voltammetric data for different biol. mols. at the ferrocene-contg. polymer electrode. Infra-red spectroscopic measurements for the "as-grown" films revealed the presence of the inorg. complex within the polymer. The modified polymer electrode showed noticeable enhancement for the **charge transfer** across the film interface and can be used as an electrochem. **sensor** for biol. compds.

L22 **ANSWER 137 OF 520** CA COPYRIGHT 2002 ACS

AN 128:257963 CA

TI New **conductive** molecular **composites**: aniline derivatives as guest molecules encapsulated and polymerized within the channels of the host 3D-coordination polymers [(Me3E)3Fe(CN)6] $\infty$  where E = Sn or Pb

AU Ibrahim, Amany M. A.

CS Department of Chemistry Faculty of Science, Ain Shams University, Cairo, Egypt

SO Journal of Materials Chemistry (1998), 8(4), 841-846

AB New **conductive** mol. **composites** have been prepd. by chem. oxidn. of **polyanilines** within the expandable wide channels of the 3D-coordination polymers [(Me3E)3Fe(CN)6] $\infty$  where E = Sn or Pb, in the presence and absence of HCl. The UV and visible absorption spectra of the protonated and deprotonated mol. **composites** are compared with those of **polyanilines**, **polyemeraldine** and nigrosine. The protonated mol. **composites** exhibit **conductivities** higher than the deprotonated ones. Also, polymn. of some aniline derivs. within the channels of the 3D-polymers, in the absence of HCl, leads to vast improvement in **cond.** owing to self protonation of the **polyemeraldine** base. The dramatic shift in optical response of the mol. **composite** contg. **polyemeraldine** base with change in pH could be used as an

optical pH **sensor** over the pH range investigated.

L22 ANSWER 153 OF 520 CA COPYRIGHT 2002 ACS

AN 128:92226 CA

TI Selective hydrogen **sensors** based on **conducting** polymers

AU Sestak, Stephen; Conn, Costa; Lake, Michael; Baker, Anthony T.; Unsworth, Joe

CS Dep. Chem., Univ. Technol., Sydney, 2007, Australia

SO Proceedings of SPIE-The International Society for Optical Engineering (1997), 3241(Smart Materials, Structures, and Integrated Systems), 118-129

AB As part of a program focussed on the development of selective **conducting** polymer **gas sensors**, the authors have studied the behavior of **polyaniline**-platinum oxide chemoresistors in the presence of combustible **gases** such as hydrogen, methane, ethylene, acetylene and carbon monoxide. The authors report on results obtained using a **polyaniline**-platinum oxide **sensor**. By hydrogen atm. preconditioning, the authors were able to increase the selectivity and sensitivity of the **sensors** for hydrogen in air at concns. between 1000 and 5400 ppm.

L22 ANSWER 160 OF 520 CA COPYRIGHT 2002 ACS

AN 128:26127 CA

TI Development of an electronic nose

AU Barisci, Joseph N.; Andrews, Mike K.; Harris, Paul; Partridge, Ashton C.; Wallace, Gordon G.

CS Intelligent Polymer Res. Inst., Univ. Wollongong, 2522, Australia

SO Proceedings of SPIE-The International Society for Optical Engineering (1997), 3242(Smart Electronics and MEMS), 164-171

AB A system for detection of **volatile** compds. has been developed based on the concept of an electronic nose. The detection mechanism relies on the change in elec. resistance that occurs when a **conducting** polymer **sensing element** is exposed to the **gaseous** sample. An array of such **sensors** in conjunction with pattern recognition data anal. are used to identify and quantify the compds. of interest.

L22 ANSWER 163 OF 520 CA COPYRIGHT 2002 ACS

AN 127:352353 CA

TI Interfacial electrochemistry of colloid-modified electrodes

AU Joo, Pal

CS Department of Colloid Chemistry, Lajos Kossuth University, Debrecen, H-4010, Hung.

SO Conference on Colloid Chemistry: In Memoriam Aladar Buzagh, Proceedings, 7th, Eger, Hung., Sept. 23-26, 1996 (1997), Meeting Date 1996, 98-101. Editor(s): Horvoelgyi, Z.; Nemeth, Zs.; Paszli, I. Publisher: Hungarian Chemical Society, Budapest, Hung.

AB The interfacial electrochem. behavior of org. polymer films (polymers of the polyester and polyurethane types contg. **tetracyanoquinodimethane** electron acceptor mols.); neg. charged, layered structure, hydrophilic and hydrophobized, swollen inorg. clay films and cationic dye and cationic surfactant incorporated clay films; **conductive**, electrochem. prepd., org. **polyaniline** films and inorg.-org. **composite** materials (clay-**polyaniline** semiconductor wires and nanowires; clay-CdS, PbS semiconductor colloidal nanoparticles) is discussed. The cathodic peak current is linearly proportional to the square root of the potential scan rate for platinum electrodes modified with calcium montmorillonite or hydrogen montmorillonite or sodium montmorillonite in NaCl soln. contg. benzoquinone.

L22 ANSWER 165 OF 520 CA COPYRIGHT 2002 ACS

AN 127:332030 CA  
TI Characterization of polymer films of pyrrole derivatives for chemical sensing by cyclic voltammetry, X-ray photoelectron spectroscopy and **vapor sorption** studies  
AU Deng, Zhiping; Stone, David C.; Thompson, Michael  
CS Department of Chemistry, University of Toronto, Toronto, ON, M5S 3H6, Can.  
SO Analyst (Cambridge, United Kingdom) (1997), 122(10), 1129-1138  
AB Eight **conducting** polymer films formed from pyrrole and N-substituted pyrrole derivs. were characterized by cyclic voltammetry, XPS, and SEM. The XPS characteristics of poly[N-butylpyrrole], poly[N-(2-carboxyethyl)pyrrole], **poly**[N-(6-hydroxyhexyl)pyrrole] and **poly**[N-(6-tetrahydropyranylhhexyl)pyrrole] are given. **Vapor** sorption was measured of **polypyrrole** films formed onto electrodes of thickness-shear mode acoustic wave **sensors**. The effect of pendant side chains is apparent in both the electrochem. behavior, compn., doping level, morphol., and the nature and extent of polymer-**vapor** interactions. The latter can be rationalized by consideration of **vapor** phys. properties and solvatochromic parameters. Films of N-substituted **polypyrroles** can be used as coating for chem. **vapor sensors** for acoustic wave devices.

L22 ANSWER 168 OF 520 CA COPYRIGHT 2002 ACS

AN 127:302684 CA  
TI Low frequency a.c. response of **polypyrrole gas sensors**  
AU Musio, Fernando; Ferrara, Maria Cristina  
CS PASTIS-CNRS, SS7 per MESAGNE Km 7.300, Brindisi, 72100, Italy  
SO Sensors and Actuators, B: Chemical (1997), B41(1-3), 97-103  
AB Elec. **conducting** org. polymers change their **cond.** and relative permittivity when exposed to **volatile** chems. The changes depend on the frequency, the concn. and the type of the chem. In particular the frequency dependence could be used for making more selective **sensors**. A **polypyrrole** (PPY) film **gas sensor** was designed and constructed in order to probe it. The low frequency (20 Hz-10 KHz) a.c. response was studied when it was exposed to 200 ppm of four different **vapors**: methanol, acetone, Et acetate and ethanol. Response patterns to each **vapor** were obtained by varying the measurement frequencies. The pattern for each **vapor** investigated was very different from the others, and so it has been possible to discriminate between them. The results demonstrate that it is possible to increase the **sensor** selectivity using the low frequency a.c. response rather than d.c. resistance change. Ageing and temp. dependence of resistance and capacitance are also reported.

L22 ANSWER 170 OF 520 CA COPYRIGHT 2002 ACS

AN 127:256914 CA  
TI **Sensor** for **volatile** materials and **gases**  
IN Cooke, Michael; Hinton, Andrew John  
PA Neotronics Limited, UK  
SO Eur. Pat. Appl., 13 pp.  
PI EP 794428 A1 19970910 EP 1997-301435 19970304  
US 6033630 A 20000307 US 1997-812090 19970304  
PRAI GB 1996-4627 19960304  
AB A **sensor** capable of distinguishing between different optical isomers (enantiomers), which **sensor** comprises a pair of spaced-apart contacts and a semi-**conductive** polymer material spanning the gap between the contacts, which polymer material includes chiral sites. The chiral sites in the polymer material are preferably formed by incorporating an optically active counterion into the polymer material, for example by growing the polymer in the presence of such a counterion, e.g. camphor sulfonic acid.

L22 ANSWER 172 OF 520 CA COPYRIGHT 2002 ACS

AN 127:228984 CA

TI **Gas sensor** test chip

AU Buehler, M. G.; Ryan, M. A.

CS Jet Propulsion Laboratory, California Institute of Technology, Pasadena, CA, 91109, USA

SO IEEE International Conference on Microelectronic Test Structures, Proceedings, Trento, Italy, Mar. 25-28, 1996 (1996), 105-110 Publisher: Institute of Electrical and Electronics Engineers, New York, N. Y.

AB A new test chip has been developed to characterize **conducting** polymers used in **gas sensors**. The chip has a seven layer co-fired alumina substrate with gold electrodes and 11 comb. The structures are designed to measure the sheet resistance, **conduction** anisotropy, and peripheral **conduction** of spin coated films that are not subsequently patterned. The resistance of the **polypyrrole** films change by a few percent in response to various alcs. Results from the test chip revealed that the **vapor** response depends on electrode geometry.

L22 ANSWER 174 OF 520 CA COPYRIGHT 2002 ACS

AN 127:221606 CA

TI Thin films of **electroactive** oligomers and polymers: application in **sensors** for hydrocarbon **vapors**, microcontact-printed liquid crystal displays and light emitting devices

AU Macdiarmid, A. G.; Feng, J.; Zhang, W. J.; Huang, Z.; Wang, P. -C.; Huang, F.

CS Department of Chemistry, University of Pennsylvania, Philadelphia, PA, 19104, USA

SO Polymer Preprints (American Chemical Society, Division of Polymer Chemistry) (1997), 38(2), 522-523

AB Thin films of doped **polypyrrole**, **polyaniline** and **polyaniline** oligomers serve as excellent **sensors** for hydrocarbon **vapors**. Rapid and reversible changes in resistance are obsd. on alternate exposure to toluene **vapor** and nitrogen. Computer derived patterned hydrophobic films are produced on hydrophilic glass substrates by a microcontact "stamp" printing technique. Thin films of **polypyrrole** and **polyaniline** are deposited preferentially on the hydrophobic pattern either electrochem. or from dil. aq. solns. of the polymg. monomer. When the patterned **polypyrrole** on a glass microscope slide is used as one electrode and ITO **conducting** glass is used as the other electrode, patterned polymer dispersed liq. crystal displays are readily produced. The characteristics of the LED's markedly improve from ITO/MEH-PPV/Al to ITO/EB/MEH-PPV/Al to ITO/doped EB/MEH-PPV/Al where EB is **polyaniline** emeraldine base.

L22 ANSWER 175 OF 520 CA COPYRIGHT 2002 ACS

AN 127:194518 CA

TI Enhanced stability, reversibility and sensitivity of **conductive** polymer-based **volatile** organic compound **sensors**

AU Yamagishi, Frederick G.; Stanford, Thomas B.; Van Ast, Camille I.; Miller, Leroy J.; Gilbert, Harold C.

CS Hughes Research Laboratories, Malibu, CA, 90265, USA

SO Proceedings - Electrochemical Society (1997), 97-19 (Chemical and Biological Sensors and Analytical Electrochemical Methods), 103-108

AB **Volatile** org. compd. (VOC) **sensors** were developed using **conductive** polymers as active transducers. Thin films of **conductive** polymers are deposited across Au inter-digitated electrodes by dipping or spinning. Transducer **cond.** can be monitored and is modulated by the presence of certain, even chem. inert, VOC. VOC detection results from structural perturbation in the **conductive** polymer caused by a direct interaction of the **conductive**

polymer with the pollutant, or from a structural change in the counterion with which the **conductive** polymer is assocd. With appropriate electronics, these **sensors** are components of a multi-**sensor** array capable of VOC speciation. **Polyaniline** and derivs. of **polythiophene** were selected as transducer **conductive** polymers. These materials are readily made in bulk quantity, and, in some cases, can be prepd. in a sol. form so that films can be prepd. by casting or spinning. Specific VOC were selected by class representatives (i.e., arom. hydrocarbons, esters, ketones) for these studies. Through appropriate combinations of silane surface coupling agents, surfactants, **conductive** polymer counter ions, and advanced signal processing techniques, sensitivity thresholds of ppm were obsd. The combination of components also enhanced **sensor** stability and reversibility.

L22 ANSWER 177 OF 520 CA COPYRIGHT 2002 ACS

AN 127:177582 CA

TI Interfacial reaction and electrochemical activity of thiokol rubber/conjugated polymer composites

AU Gong, Ke-Cheng; Ma, Wen-Shi

CS Polymer Structure & Mod. Res, Lab., South China University of Technology, Canton, 510641, Peop. Rep. China

SO Materials Research Society Symposium Proceedings (1997), 461 (Morphological Control in Multiphase Polymer Mixtures), 87-92

AB The highly **electroactive** thiokol rubber (TR)/conjugated polymer (e.g. **polyaniline** (PAn) or **polypyrrole** (PPy)) **composite** films were prepd. by electropolymn. deposition via a 1-step process in electrolytic solns. contg. aniline or pyrrole and TR oligomer. The electrocatalysis of PAn or PPy for the electrodepolymn. (redn.)-electropolymn. (oxidn.) reaction of TR in the interface between PAn or PPy and TR is detd. by cyclic voltammograms. The difference between the oxidn. potential and the redn. potential is 0.05V and 0.36V or less for TR/PAn and TR/PPy composite films, resp. The chem. bands between the N atoms of PAn or PPy and the mercaptan groups of TR (oligomer) are formed in the electropolymn. process as indicated by XPS. The **conductivities** of TR/PAn and TR/PPy composite films and the stability of the cells consisting of those films are remarkably improved after electrochem. redn. with addn. of a suitable **conducting carbon black**.

L22 ANSWER 179 OF 520 CA COPYRIGHT 2002 ACS

AN 127:149481 CA

TI Modified **polyanilines** via electrochemical copolymerization of aniline and para-phenylenediamine derivatives

AU Yang, Chien-Hsin; Wen, Ten-Chin

CS Department of Chemical Engineering, Kung Shan Institute of Technology, Tainan, 70101, Taiwan

SO Journal of the Electrochemical Society (1997), 144(6), 2078-2085

AB Copolymn. of 2,5-diaminobenzenesulfonic acid (DABSA) and para-phenylenediamine (PPDA) with aniline (AN), was electrochem. performed by cyclic voltammetry on IrO<sub>2</sub>-coated electrodes in 1 M HCl. The copolymn. rate strongly depends on the amt. of DABSA/PPDA in the comonomer feed. Crosslinking and branching reactions occur simultaneously during copolymn. when the fraction of DABSA is larger than 0.206 M in the DABSA-AN comonomer feed. The reactions occur in the PPDA-AN copolymn. system at PPDA levels of 0.102 M in the comonomer feed. The XPS C1s lines show that the net charge residing on the carbon atoms is not affected by reaction time (cycle no.) or by the DABSA/PPDA fraction in the feed. The N1s lines show that the second component peak corresponding to an amine site at 400.4 eV is more dominant for both DABSA and PPDA-modified **polyanilines**. Composite films of DABSA/PPDA-AN copolymer with waterborne polyurethane were prepd.



and the **cond.** was measured to compare the effect of DABSA/PPDA in the comonomer feed. The DABSA-AN copolymer film is more stable than a PPDA-AN copolymer film. The electrochem. response of the modified **polyaniline** films to dissolved hydroquinone and Fe(CN)<sub>6</sub>-4 was also examd.; the DABSA-AN films retarded the electrode reactions of both species, but the PPDA-AN films catalyzed the electrode reaction of hydroquinone, but not Fe(CN)<sub>6</sub>-4. The elec. **cond.** of the DABSA-AN copolymers decreases with increasing DABSA content. The max. **cond.** of PPDA-AN copolymers film was reached with a PPDA feed ratio of 0.102 M, and the **cond.** of the **composites** is lower than that of **polyaniline**.

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AN 127:132941 CA

TI A new method for dispersing palladium microparticles in **conducting** polymer films and its application to biosensors

AU Yamato, Hitoshi; Koshiba, Takafumi; Ohwa, Masaki; Wernet, Wolfgang; Matsumura, Michio

CS International Research Laboratories, Ciba-Geigy (Japan) Ltd., 10-66 Miyuki-cho, Takarazuka, 665, Japan

SO Synthetic Metals (1997), 87(3), 231-236

AB **Composite** films of **polypyrrole**/sulfated poly( $\beta$ -hydroxyethers) (PPy/S-PHE) are elec. **conducting** and mech. flexible. Palladium particles were dispersed in the films by thermally decomp. bis(dibenzylideneacetone)palladium(0) complex which had been absorbed by the films from a CHCl<sub>3</sub> soln. This method for loading metal particles was enabled by the high affinity of the **composite** films for org. compds. TEM and energy-dispersive x-ray spectrometry (EDX) analyses revealed that fine palladium particles in the nanometer range are dispersed in the PPy/S-PHE **conducting** films. A glucose **sensor** based on the detection of hydrogen peroxide was prepd. by immobilizing glucose oxidase (GOD) using glutaraldehyde on a Pd/PPy/S-PHE electrode. This biosensor responded to glucose even at 400 mV vs. Ag/AgCl, which is lower than the working potential of conventional glucose **sensors** prepd. on a platinum electrode.

L22 ANSWER 183 OF 520 CA COPYRIGHT 2002 ACS

AN 127:122161 CA

TI Nanometer-scale structure of hectorite-aniline intercalates

AU Porter, Timothy L.; Thompson, D.; Bradley, M.

CS Dep. Physics Astronomy, Northern Arizona Univ., Flagstaff, AZ, 86011, USA

SO Journal of Vacuum Science & Technology, A: Vacuum, Surfaces, and Films (1997), 15(3, Pt. 1), 500-504

AB The inclusion of the org. guest aniline into Cu(II)-exchanged hectorite thin films has been investigated. The subsequent polymn. of aniline on the clay surface and in the intergallery regions are studied using scanning force microscopy (SFM), ESR spectroscopy, powder x-ray diffraction (XRD), and impedance spectroscopy. EPR and XRD data show that in addn. to strong polymn. of aniline on the clay surface, polymn. also occurs in the intergallery regions of the clay. Using std. lift-off techniques or razor cleaving, the exposed intergallery **polyaniline** is successfully imaged for the first time using noncontract SFM in phase-contrast mode. The nearly two-dimensional polymer sheets formed in these regions exhibit none of the nanometer-scale grain or bundle structure commonly assocd. with **polyaniline** synthesized using techniques such as electrochem. or vacuum deposition. The elec. response of the resulting clay-**conducting** polymer **composites** is also investigated for thin films fabricated on 15  $\mu$ m interdigitated arrays. These **composite** materials may be highly suitable as chem. **sensors** for a variety of important gases and vapors such as ethanol and hexane.



L22 ANSWER 185 OF 520 CA COPYRIGHT 2002 ACS

AN 127:101674 CA

TI "Electronic noses" and microcontact-printed liquid crystal displays using conjugated polymers

AU Macdiarmid, Alan G.; Zhang, Wanjin; Adebimpe, David E.; Wang, Pen-Cheng; Huang, Zheyuan

CS University of Pennsylvania, PA, USA

SO Annual Technical Conference - Society of Plastics Engineers (1997), 55th(Vol. 2), 1454-1458

AB Thin films of doped **polypyrrole** on interdigitated gold arrays serve as **gas sensors** undergoing reversible changes in resistance upon exposure to **gases** (e.g., to alternating exposure to a stream of toluene **vapor** in nitrogen and to nitrogen alone). Analogous types of changes together with changes in vis/UV spectra occurred with poly(3-hexylthiophene) **sensors** in a static system. Microcontact-printed patterns of **polypyrrole** can be readily used in conjunction with a com. liq. crystal **blend** to produce patterned liq. crystal displays.

L22 ANSWER 186 OF 520 CA COPYRIGHT 2002 ACS

AN 127:81858 CA

TI Enhanced sensitivity in sensory materials: conducting polymer-based polyreceptor assemblies

AU Swager, Timothy M.

CS Department of Chemistry, Massachusetts Institute of Technology, USA

SO Annual Technical Conference - Society of Plastics Engineers (1997), 55th(Vol. 2), 1476-1479

AB We will present a no. of approaches to the design and synthesis of conducting polymer-based sensory materials. Conducting polymers are ideal sensory materials since their cond. and photophys. properties are very sensitive to chem. compn. and electronic perturbations. We have synthesized **polythiophenes** which display ion specific changes in their band gap. Other approaches to ion sensory materials make use of the electronic perturbation induced by ion complexation. We have also developed polymers which contain electron rich macrocycles capable of hosting electron poor org. compds. These **charge transfer** complexes are a direct result of the macrocyclic structure and are not obsd. in non-macrocyclic analogs. In one system we have demonstrated a novel chemoresistive effect in which the cond. is lowered by paraquat. We have also demonstrated how a fluorescence-based chemosensory response can be enhanced (amplified) by migration of the photogenerated exciton to a complexed site.

L22 ANSWER 187 OF 520 CA COPYRIGHT 2002 ACS

AN 127:66785 CA

TI High sensitivity photodetectors made with **charge transfer** polymer blends

AU Yu, Gang; Gao, Jun; Yang, Cuiying; Heeger, Alan J.

CS UNIAx Corporation, Santa Barbara, CA, 93117-3022, USA

SO Proceedings of SPIE-The International Society for Optical Engineering (1997), 2999(Photodetectors: Materials and Devices II), 306-314

AB Blending org. semiconductors with different electron affinities results in an interpenetrating bi-continuous network of internal donor/acceptor (D/A) heterojunctions. These nano-scale D/A junctions show efficient charge sepn. and **charge transfer**. The interpenetrating bi-continuous networks of the donor and the acceptor phases also allow the sepd. carriers to be collected effectively at the anode and cathode contacts. Materials used for the donor phase are the conjugated polymers poly(3-octylthiophene) or poly[2-methoxy-5-(2-ethylhexyloxy)-1,4-phenylenevinylene] (MEH-PPV). Typical materials used for the acceptor phase are fullerene mols. (such as C60 and its functional derivs.). These photosensitive materials are sol.

to common org. solvents, and are processable at room temp. Photodiodes and photovoltaic cells were fabricated with high quantum efficiencies. The carrier collection efficiency and energy conversion efficiency of MEH-PPV:C60 photovoltaic cells are ~29% electrons/photon and ~3% under illumination of 20 mW/cm<sup>2</sup> at 430 nm, two orders of magnitude higher than that in devices with MEH-PPV alone. The photosensitivity and the quantum yields increase to 0.26 A/W and ~75 % electrons/photon at reverse bias of -2V, even higher than those in UV-enhanced Si photodiodes at the same wavelength. Large size photodetectors and image **sensors** have been fabricated with these materials.

L22 ANSWER 190 OF 520 CA COPYRIGHT 2002 ACS

AN 126:350948 CA

TI Application of poly(thienylene vinylene) as a chemiresistor for organic **vapors**

AU De Wit, M.; Vanneste, E.; Blockhuys, F.; Geise, H. J.; Mertens, R.; Nagels, P.

CS University of Antwerp, UIA, Dept. Chemistry, Universiteitsplein 1, Antwerp, 2610, Belg.

SO Synthetic Metals (1997), 85(1-3), 1303-1304

AB Results are reported about the application of I doped poly(thienylene vinylene) (PTV) as a **conductometric sensor**. A description is given of the layout of the **sensor**, formed by spin coating the sol. precursor polymer on an alumina substrate with Au contacts. The set-up for generating continuous **vapor** flows over the **sensor** and the monitoring of the elec. resistance are briefly discussed. Responses (%Ra) of the **sensor** to nine satd. **vapors** are reported. Recovery (%Rb) from the response is in general not complete and characteristic for the **vapor**. The partial recovery is not a poisoning effect and does not affect the reproducibility; on the contrary, graphical combination of %Ra and %Rb shows addnl. information.

L22 ANSWER 191 OF 520 CA COPYRIGHT 2002 ACS

AN 126:331274 CA

TI Synthesis and characterization of **conducting** polymers and their **composites**

AU Toppare, L.

CS Department of Chemistry, Bilkent University, Ankara, 06533, Turk.

SO Turkish Journal of Chemistry (1997), 21(1), 30-34

AB **Blends** of the **conducting** polymers **polypyrrole** and **polyaniline**, in insulating host polymers, bisphenol A polycarbonate, polyamide and polyamide, have been prepd. electrochem. **Composite** homogeneity and a possible chem. interaction between the host matrixes and the **conducting** polymers were studied. Several spectroscopic and thermal **analyses** of free standing **films** suggest such an interaction.

L22 ANSWER 193 OF 520 CA COPYRIGHT 2002 ACS

AN 126:306088 CA

TI Inhomogeneous charge transport in **conducting polyaniline**

AU Du, G.; Avlyanov, J.; Wu, C. Y.; Reimer, K. G.; Benatar, A.; MacDiarmid, A. G.; Epstein, A. J.

CS Department of Physics, The Ohio State University, Columbus, OH, 43210-1106, USA

SO Synthetic Metals (1997), 85(1-3), 1339-1340

AB Charge transport studies were carried out of two **composite** systems, CSA [camphor sulfonic acid]-**polyaniline** (CSA-PAN) in Nylon-12 blends and TSA [toluenesulfonic acid]-PAN coated **carbon black** (CB). The CSA-PAN/Nylon samples showed a temp. dependent insulator-metal transition and an anomalous high microwave absorption while the TSA-PAN/CB samples showed an unusual insulator to metal transition from the individual materials to the

composites. The common mechanism is inhomogeneous charge transport due to formation of ordered regions (metallic islands) during the polymn. of **conducting polyaniline** in both **composites**.

L22 **ANSWER 197 OF 520** CA COPYRIGHT 2002 ACS

AN 126:287201 CA

TI **Conducting** polymer based pH **detector**: a new outlook to pH sensing technology

AU Talaie, Afshad

CS Chemical Engineering Department, The University of Sydney, NSW 2006, Australia

SO Polymer (1997), 38(5), 1145-1150

AB The development of a new pH sensing technol. using **conducting** polymers is addressed. Three different polymers were examd. as new pH **sensor** materials. The resistance of **polypyrrole** and **polyaniline** are pH dependent. The **composite** made of these two polymeric systems suggest a promising supramol. structure for pH **sensor** applications.

L22 **ANSWER 201 OF 520** CA COPYRIGHT 2002 ACS

AN 126:239303 CA

TI **Conducting composites** derived from **polyaniline** and benzobisthiazole rigid rod polymer

AU Tan, Loon-Seng; Simko, S. R.; Bai, S. J.; Vaia, R. A.; Spry, R. J.

CS Polymer Branch, Wright Lab., Wright Patterson Air Force Base, OH, 45433-7750, USA

SO Polymer Preprints (American Chemical Society, Division of Polymer Chemistry) (1997), 38(1), 239-240

AB As an alternate method for processing **polyaniline** (PANI) from its **conducting** (protonated) state, vacuum-casting of PANI from its methanesulfonic acid (MSA) soln. can provide films with elec. **cond.** values of 128-152 S/cm. In addn., the authors have also shown that PANI.MSA/poly(**p-phenylene** benzobisthiazole) (PBZT) composite films with PANI content ranging from 2-90 wt% can also be prepd. similarly. **Cond.** values spans from less than 10-10 S/cm to 124 S/cm and nicely followed a percolation pattern. Although grossly phase-sepd. with PBZT domain sizes of 1-10 mm by 0.5-2 mm, these cast films showed relatively low percolation threshold (fc. ca.. 3.5%). This compared well with the **cond.** values for the PANI.H2SO4/poly(**p-phenylene** terephthalamide) (PPTA) composite fibers which were also phase-sepd.

L22 **ANSWER 205 OF 520** CA COPYRIGHT 2002 ACS

AN 126:146223 CA

TI Polymer-C60 **charge transfer** blends: Enhanced photosensitivity via a bicontinuous network of donor/acceptor heterojunctions

AU Yu, Gang; Heeger, Alan J.

CS UNIAx Corporation, Santa Barbara, CA, 93117, USA

SO Proceedings of SPIE-The International Society for Optical Engineering (1996), 2854(Fullerenes and Photonics III), 123-128

AB Optical quality org. blend films were developed with high photosensitivity. These materials are composed with conjugated polymers (such as poly(3-octylthiophene), P3OT, or poly(2-methoxy-5-(2'-ethyl-hexyloxy)-1,4-phenylene vinylene), MEH-PPV) and fullerene mols. (such as C60). These blends are sol. to common org. solvents, and are processable at room temp. Thin film devices in sandwich configurations were fabricated with high quantum efficiency. The carrier collection efficiency and energy conversion efficiency in the MEH-PPV:C60 photovoltaic cells are ~29% electrons/photon and 2.9% resp., better by more than two orders of magnitude than devices made with MEH-PPV alone. The photosensitivity are

even higher with reverse bias, ~0.2 A/W - 0.3 A/W in visible region at a few volts. These nos. are comparable to photodiodes made with inorg. semiconductors.

- L22 ANSWER 208 OF 520 CA COPYRIGHT 2002 ACS  
AN 126:41393 CA  
TI Superconductor composite comprising electrically **conducting** polymer and its manufacture  
IN Yoshino, Katsumi; Anbaa, Ei Zakiidofu; Oonishi, Toshihiro  
PA Yoshino, Katsumi, Japan; Sumitomo Chemical Co  
SO Jpn. Kokai Tokyo Koho, 4 pp.  
PI JP 08264038 A2 19961011 JP 1995-69202 19950328  
AB The composite contains an elec. **conducting** polymer and plural dopants. The composite is manufd. by doping a fullerene-doped elec. **conducting** polymer with an alkali metal and/or an alk. earth metal. The composite is manufd. by doping an elec. **conducting** polymer with an alkali metal- and/or alk. earth metal-doped fullerene. The composite showed stable superconductor characteristics and good flexibility.
- L22 ANSWER 211 OF 520 CA COPYRIGHT 2002 ACS  
AN 125:346596 CA  
TI Multi-frequency measurements of organic **conducting** polymers for sensing of **gases** and **vapors**  
AU Amrani, M. E. Hassan; Payne, Peter A.; Persaud, Krishna C.  
CS Dep. Instrumentation and Anal. Sci., Manchester, M60 1QD, UK  
SO Sensors and Actuators, B: Chemical (1996), B33(1-3), 137-141  
AB Elec. **conducting** org. polymers display elec. **conductivities** that are dependent on the concn. of dopant ions incorporated in the material. The **cond.**, usually measured using d.c. techniques, may be modulated reversibly and rapidly at ambient temp. by adsorption and desorption of **volatile** chems. This phenomenon has immense practical use for **gas** and odor sensing. By using arrays of **conducting** polymer **sensors** having broadly overlapping specificity to a range of **volatiles**, we are able to measure and assign descriptors to the **volatiles**. In this paper we show that similar descriptors can be generated by using a.c. (ac) at suitable frequencies to follow the changes in **sensor** capacitance, **conductance** and dissipation factor. We also show that using a single **sensor** we can obtain discrimination between chem. species. The ac response characteristics of these **sensors** have been modelled using a simple elec. circuit equiv. and we show that the model is a good predictor of **sensor** performance.
- L22 ANSWER 214 OF 520 CA COPYRIGHT 2002 ACS  
AN 125:312174 CA  
TI **Conducting** polymer **sensors**  
AU Barisci, J. N.; Conn, C.; Wallace, G. G.  
CS Dept. of Chemistry, Univ. of Wollongong, Wollongong, NSW 2522, Australia  
SO Trends in Polymer Science (Cambridge, United Kingdom) (1996), 4(9), 307-311  
AB This review examines recent advances in the application of elec. **conducting** polymers in sensing devices. Methods of signal generation, mainly elec. and electrochem., are discussed, as are strategies for introducing into the polymer structure appropriate analyte recognition characteristics. The use of **conducting** polymers in **gas sensors** and in soln. **sensors** for detection of chem. and biochem. species is reviewed. 46 Refs.
- L22 ANSWER 217 OF 520 CA COPYRIGHT 2002 ACS  
AN 125:291909 CA  
TI A sense of (electronic) smell  
AU Mills, Graham; Walsh, Frank; Whyte, Ian

- CS School Chemistry, Physics, Radiography, University Portsmouth, Portsmouth, UK
- SO Chemical Technology Europe (1996), 3(4), 26-30
- AB A review with 28 refs. on the development of electronic odor and **gas sensors**, describing the principle of detection, the sensing systems (including the **conducting** polymers, such as **polyaniline**, **polypyrrole**, and **polythiophene**, and metal oxides), data anal., and applications.
- L22 ANSWER 226 OF 520 CA COPYRIGHT 2002 ACS
- AN 125:128836 CA
- TI Interaction between electroconducting polymers and C60
- AU Frackowiak, Elzbieta; Beguin, Francois
- CS ICAE, Technical Univ., Poznan, 60-965, Pol.
- SO Journal of Physics and Chemistry of Solids (1996), 57(6-8, Proceedings of the 8th International Symposium on Intercalation Compounds, 1995), 983-989
- AB The combination of outstanding properties of fullerenes as good electron acceptors and conducting polymers as excellent donors was taken into consideration. For investigation, **polyaniline** was chosen due to the nucleophilic character of the NH groups. The possibility of **charge transfer** interaction between C60 and emeraldine base of **polyaniline** during the formation of soln. casting films was carefully studied. Physicochem. properties of the formed **films** were investigated using microscopic anal. (SEM, AFM), EPR investigation, and cond. expts. A small increase of one order in their elec. cond. was found. Semiconducting behavior of the formed films was confirmed through the temp. dependence. All the investigations clearly proved a strong effect of solvent, i.e. N-methylpyrrolidinone (NMP) on the characteristics of the doped films. The nucleophilic addn. of NMP on C60 is suggested rather than a complete **charge transfer**. The small increase in elec. cond. and almost unchanged EPR characteristics are indicative of hardly noticeable **charge transfer** due to the steric hindrance caused by the large size of the fullerene mols.
- L22 ANSWER 228 OF 520 CA COPYRIGHT 2002 ACS
- AN 125:122398 CA
- TI **Composites** of **polypyrrole** and **carbon black**: 4. Use in environmental pollution abatement of hexavalent chromium
- AU Wampler, W. A.; Basak, S.; Rajeshwar, K.
- CS Fort Worth Res. Cent., Sid Richardson Carbon Co., Forth Worth, TX, 76106, USA
- SO Carbon (1996), 34(6), 747-755
- AB **Composites** of an electronically **conducting** polymer (**polypyrrole**) with **carbon black** were used to reduce Cr(VI) to the less toxic Cr(III) in aq. media. The **carbon black** content in these composites was varied from ~5 to ~65% by wt.; an increase in the **carbon black** fraction increased the ability of the composite to reduce Cr(VI). The **composite** outperformed both its components, namely **polypyrrole** and **carbon black**, in its ability to treat Cr(VI). The Cr(VI) conversion obeyed pseudo 1st-order kinetics. The mechanistic and practical implications of this Cr(VI) pollution abatement approach are discussed.
- ©L22 ANSWER 239 OF 520 CA COPYRIGHT 2002 ACS
- AN 124:318996 CA
- TI Dielectric properties of **conductive** composites at microwave frequencies
- AU Forsyth, M.; Gregory, E.; Davie, E.; McCulloch, D.
- CS Department Materials Engineering, Monash University, Clayton, 3168, Australia
- SO Advances in Science and Technology (Faenza, Italy) (1995), 4(New Horizons for Materials), 279-286

AB The **cond.** and dielec. properties of **conductive** polymer **composites** based on **polypyrrole**, **polyaniline** and **carbon black** fillers combined with polyurethane and polystyrene matrixes are presented. Real and imaginary permittivity of these composites are measured at frequencies between 0.2GHz and 18GHz using various sample configurations. The DC **cond.** of these composites display the typical percolation behavior previously obsd. in such materials. Electron microscopy indicates that the **conductive** particles are not homogeneously distributed within the matrix, particularly in the case of the intrinsically **conductive** polymers. The effect of the filler concn. on the microwave dielec. properties is also discussed. **Polypyrrole composites** have considerably higher permittivities than those based on **carbon black**, despite the higher **cond.** and lower percolation threshold of the **carbon black** composites.

©L22 ANSWER 240 OF 520 CA COPYRIGHT 2002 ACS

AN 124:305963 CA  
TI Novel **composite** organic-inorganic semiconductor **sensors** for the quantitative detection of target organic **vapors**  
AU de Lacy Costello, Benjamin P. J.; Evans, Phillip; Ewen, Richard. J.; Honeybourne, Colin L.; Ratcliffe, Normal M.  
CS Fac. Applied Sciences, Univ. West of England, Bristol, BS16 1QY, UK  
SO Journal of Materials Chemistry (1996), 6(3), 289-94  
AB **Composites** of tin dioxide (an n-type semiconductor) and deriv. of the **conducting** polymer **polypyrrole** (a p-type semiconductor) gave reversible changes in elec. resistance at room temp. when exposed to a range of org. **vapors**. The optimum amt. of polymer giving highest sensitivity was found by expt. to be 2.5% by mass for the **polypyrrole** chloride-tin dioxide **composite**. **Composites** contg. 2.5% polymer by mass, but differing in polymer deriv. were fabricated and exposed to low concns. of ethanol, methanol, acetone, Me acetate and Et acetate. All gave significant and reversible decreases in elec. resistance. Direct comparison with **sensors** constructed solely of tin dioxide or **polypyrrole** at room temp. showed the **composites** to be more sensitive. The **gas** sensitivity of the **composite** materials depended on the type of polymer deriv. incorporated and the dopant anion assocd. with the polymer. The **composites** were simple to fabricate and gave differing response profiles to a range of org. **vapors**.

L22 ANSWER 244 OF 520 CA COPYRIGHT 2002 ACS

AN 124:210695 CA  
TI **Carbon black** and **carbon black-conducting** polymer composites for environmental applications  
AU Rajeshwar, Krishnan; Wampler, Wesley A.; Goeringer, Scott; Gerspacher, Michel  
CS Department Chemistry and Biochemistry, University Texas, Arlington, TX, 76019-0065, USA  
SO Preprints of Papers - American Chemical Society, Division of Fuel Chemistry (1996), 41(1), 498-502  
AB **Composites** outperform **polypyrrole** and **carbon black** in terms of their ability to reduce Cr(VI). In the **composite**, redox (**polypyrrole**) and oxidizable (**carbon black**) functions are built the material framework. The former is reversible and the latter is irreversible.

L22 ANSWER 247 OF 520 CA COPYRIGHT 2002 ACS

AN 124:163755 CA  
TI A selective **gas sensor** using a **polypyrrole** thin film as a **sensitive** matrix on a piezoelectric crystal  
AU Nigorikawa, Kiyomi; Kunugi, Yoshihito; Harima, Yutaka; Yamashita, Kazuo

- CS Division of Material and Life Sciences, Faculty of Integrated Arts and Sciences, Hiroshima University, 1-7-1 Kagamiyama, Higashi-Hiroshima, 739, Japan
- SO Journal of Electroanalytical Chemistry (1995), 396(1-2), 563-7
- AB A novel **gas sensor** is fabricated from simultaneous measurements of resistance changes ( $\Delta R$ ) and mass changes ( $\Delta M$ ) of a **conducting polypyrrole** (PP) film assembled on a piezoelec. crystal. Mol. species such as acetone, methanol and ethanol can be recognized by the  $(\Delta R/R_0)/(\Delta M/M_0)$  values, where  $R_0$  and  $M_0$  are the initial resistance and wt. of the PP film resp. But the quant. anal. of the **vapor** mols. can be achieved by measuring the  $\Delta R/R_0$  or  $\Delta M/M_0$  values. For primary alcs. the homologs can also be recognized by the simultaneous measurement of  $\Delta R$  and  $\Delta M$ . Also, this **sensor** is usable to clarify the interactions between the PP film and the **vapor** mols.
- L22 **ANSWER 248 OF 520** CA COPYRIGHT 2002 ACS
- AN 124:125947 CA
- TI A new approach to Cr(VI) remediation based on the use of **polypyrrole** and **carbon black**
- AU Rajeshwar, K.; Wei, C.; Basak, S.; Wampler, W. A.
- CS Dep. of Chemistry and Biochemistry, Univ. of Texas at Arlington, Arlington, TX, 76019, USA
- SO Proceedings - Electrochemical Society (1995), 95-12(Proceedings of the Symposium on Electrochemical Technology Applied to Environmental Problems, 1995), 121-31
- AB **Electroconductive** polymers, such as **polypyrrole**, are being considered for a wide range of applications. In this paper, proof of concept is provided to show their utility for toxic waste cleanup. **Polypyrrole** is capable of the fast and efficient redn. of Cr(VI) in aq. media. An electrochem. post-treatment restores the redn. capacity of the polymer for use in further cleanup cycles. **Carbon black** can be used in a similar manner. However, it has been shown that **composites** of **polypyrrole** and **carbon black** are more effective than either used in isolation.
- L22 **ANSWER 271 OF 520** CA COPYRIGHT 2002 ACS
- AN 123:85260 CA
- TI Preparation and characterization of **polyaniline**-palladium **composite** films
- AU Li, Hongshi; Baer, D. R.; Engelhard, M. H.; Janata, J.; Josowicz, M.
- CS Environ. Mol. Sci. Lab., Pacific Northwest Lab., Richland, WA, 99352, USA
- SO Materials Research Society Symposium Proceedings (1995), 369(Solid State Ionics IV), 581-5
- AB Electrosynthesized **polyaniline** (PANi) can be chem. functionalized by incorporation of palladium clusters. The functionalization of electrochem., freshly prepd. and dried PANi film occurs spontaneously during the relaxation process. This process is carried out in sulfuric acid contg. palladium salt. The material properties of the new composite PANi-Pd film were investigated by applying electrochem., UV-visible spectroscopic and surface microscopy techniques. The PANi-Pd composite materials behaved electrochem. different than PANi film alone or Pd film deposited electrochem. This finding is particularly important for developing layers for chem. **sensors**, electrocatalysis or supercapacitors applications.
- L22 **ANSWER 273 OF 520** CA COPYRIGHT 2002 ACS
- AN 123:56769 CA
- TI **Composites** of **polypyrrole** and **carbon black**. Part III. Chemical synthesis and characterization
- AU Wampler, Wesley A.; Rajeshwar, Krishnan; Pethe, R. G.; Hyer, R. C.; Sharma, S. C.

CS Fort Worth Res. Center, Sid Richardson Carbon Co., Fort Worth, TX, 76106, USA

SO Journal of Materials Research (1995), 10(7), 1811-22

AB A new class of mol. composites of **carbon black** and an electronically **conducting polypyrrole** has been synthesized by chem. polyimg. pyrrole in an aq. dispersion of **carbon black**. The **carbon black** content of these composites can be varied from ~5% to ~85% (by wt.). The surface areas and densities of these composites were compared to corresponding mixts. of **carbon black** and **polypyrrole**. The influence of **carbon black** on the efficiency of polymn. of pyrrole is described. The effect of **carbon black** content on the electronic **cond.** of the composite has been mapped, and compared with the corresponding behavior of a mixt. of **carbon black** and poly(vinyl chloride). The influence of the parent black characteristics (porosity, void vol., surface area) on the electronic **cond.** of the resultant composite has been probed by comparing the behavior of composites derived from six com. and exptl. blacks. The temp. dependence of the composites has been studied as a function of the **carbon black** content. The application of these new materials is examd.

L22 ANSWER 275 OF 520 CA COPYRIGHT 2002 ACS

AN 123:39706 CA

TI The development of an electronic 'nose' for industrial and environmental applications

AU Hodgins, Diana

CS Neotronics Limited, Parsonage Road, Takeley near Bishops Stortford Herts., CM22 6PU, UK

SO Sensors and Actuators, B: Chemical (1995), B27(1-3), 255-8

AB The described electronic nose deals entirely with a **conducting polymer sensor** system which works on the principle of 12 different **sensors** monitoring a complex **vapor** in the headspace above a sample. The ability of any system to mimic the human nose depends primarily on **sensor** characteristics; therefore, most of the development work has been on **sensor** materials and the fabrication process. The range of **sensors** described exhibits significantly different responses to most **vapors** tested. Using 12 of these **sensors**, a very good discrimination was achieved between very similar samples over a wide range of products. The complete system is easy to use in the lab., and software was developed to enable the complex data to be analyzed and presented in a simple summary form.

L22 ANSWER 282 OF 520 CA COPYRIGHT 2002 ACS

AN 122:225116 CA

TI Preparation and characterization of **polyaniline**-palladium **composite** films

AU Li, Hong-Shi; Josowicz, M.; Baer, D. R.; Engelhard, M. H.; Janata, J.

CS Pacific Northwest Lab., Environmental Mol. Sci. Lab., Richland, WA, 99352, USA

SO Journal of the Electrochemical Society (1995), 142(3), 798-805

AB Palladium is a preeminent material for the prepn. of **sensors** for hydrogen and hydrogen-evolving compds. **Conducting polyaniline** can be chem. or electrochem. functionalized by the incorporation of palladium clusters. Different interfaces in a three-dimensional matrix for hydrogen adsorption, desorption, and evolution were synthesized and characterized. Dispersions of palladium clusters in the polymer film were formed by various prepn. routes, which can be classified as 1- or two-step processes. In the 1-step process, the **composite** material was obtained during the electrosynthesis of **polyaniline** film. In the two-step processes, Pd aggregated into the **polyaniline** modified electrode. Electrochem. examn., XPS, and Auger electron spectroscopy were employed to characterize the **composite** materials in view of the hydrogen sorption and evolution as well as the binding



energy state and the spatial distribution of the palladium clusters in **polyaniline** film.

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AN 122:189535 CA

TI **Composites of Polypyrrole and Carbon Black**. 2. Electrosynthesis, Characterization and Influence of **Carbon Black** Characteristics

AU Wampler, Wesley A.; Wei, Chang; Rajeshwar, Krishnan

CS Fort Worth Research Center, Sid Richardson Carbon Co., Fort Worth, TX, 76106, USA

SO Chemistry of Materials (1995), 7(3), 585-92

AB A variety of **polypyrrole** (ppy)-**carbon black** composites with the **carbon black** content ranging from 10 to ~80 wt % were electrochem. synthesized from aq. dispersions of **carbon black** contg. pyrrole monomer. An electrotrapping mechanism is proposed for the composite film growth; the neg. charged **carbon black** particles are attracted toward the (pos. charged) anode surface where they are assimilated into the growing ppy matrix. The presence of **carbon black** enhanced the charge-storage capacity and the electronic **cond.** of the parent polymer in the resultant electrocomposite as measured by cyclic voltammetry in 0.1 M KCl. The influence of **carbon black** characteristics on these two properties of the composite was explored by examg. composites electrochem. synthesized from seven com. blacks encompassing a wide range of surface area, porosity, void vol., and electronic **cond.** Two different **carbon black** soln. loads (10 and 20 g/L) were employed in these expts. The **carbon black** porosity and its sp. surface area exerted a pos. effect on the ability of the ppy-**carbon black** composite to store charge. Similarly, an increase in the structure of the **carbon black** had a pos. effect on the c.d. (i.e., the electronic **cond.**) of the resultant composite. However, the Printex XE-2 **carbon black** based composite showed anomalously low charge-storage capacity and c.d. in 0.1 M KCl despite the high porosity and structure of its **carbon black** component. Possible reasons for this are discussed as are data obtained by previous researchers on other types of ppy-carbon composites.

L22 ANSWER 299 OF 520 CA COPYRIGHT 2002 ACS

AN 121:270692 CA

TI Nanostructured electrode membranes

IN Parsonage, Edward E.; Debe, Mark K.

PA Minnesota Mining and Mfg. Co., USA

SO PCT Int. Appl., 41 pp.

PI WO 9415210 A1 19940707

WO 1993-US11814 19931207

US 5338430 A 19940816

US 1992-995891 19921223

PRAI US 1992-995891 A 19921223

AB A **composite** film comprising a no. of nanostructured elements, wherein these elements are either two-component sub-microscopic structures comprised of whiskers conformally coated with a **conducting**, preferentially catalytically active material or one-component sub-microscopic structures comprised of a **conducting**, preferentially catalytically active material, such that the nanostructured elements are embedded in an encapsulant, which can be a solid electrolyte. The **composite** film can be used as an electrode membrane in an electrochem. cell or an analyte **sensor**.

L22 ANSWER 302 OF 520 CA COPYRIGHT 2002 ACS

AN 121:231830 CA

TI Electronic and ionic transport in processable **conducting** polymers

AU Pomerantz, M.; Reynolds, J. R.; Rajeshwar, K.; Marynick, S.

CS Cent. Adv. Polymer Res., Univ. Texas, Arlington, TX, USA

SO Report (1993), TR-40; Order No. AD-A260223, 10 pp. Avail.: NTIS From: Gov.

Rep. Announce. Index (U. S.) 1993, 93(11), Abstr. No. 331,453

AB This the Final Report for this grant and includes major results along with publications. Some results noted include prepn. and study of a low band-gap transparent **conducting** polymer, poly(1,4-bis(2-heteroaryl)-**p-phenylenes**), **electroactive** transition metal contg. polymers and **conducting** polymer composites. In addn., many studies dealing with ion transport upon redox switching of these **electroactive** polymers have been carried out and new probes to monitor these ion fluxes have been developed. A highly efficient **polypyrrole** platinum nano-**composite**, with useful catalytic properties has also been developed. Accurate theor. and computational techniques, along with a modified Extended Hueckel band structure procedure, have been developed.

L22 ANSWER 321 OF 520 CA COPYRIGHT 2002 ACS  
 AN 120:193484 CA  
 TI Electrocomposites of **polypyrrole** and **carbon black**  
 AU Wampler, Wesley A.; Wei, Chang; Rajeshwar, Krishnan  
 CS Fort Worth Res. Cent., Sid Richardson Carbon Co., Fort Worth, TX, 76106, USA  
 SO Journal of the Electrochemical Society (1994), 141(2), L13-L15  
 AB Aq. dispersions of **carbon black** were used to electrosynthesize **polypyrrole-carbon black composites**, with a **carbon black**-content range of 10-80 wt. percent. These electrocomposites showed enhanced charge storage capacity (relative to pure **polypyrrole**) and, more importantly, retained good elec. **cond.** even at potentials wherein the polymer was in the reduced (insulating) state.

L22 ANSWER 383 OF 520 CA COPYRIGHT 2002 ACS  
 AN 116:200221 CA  
 TI Electrodes for **gas sensors** using electrode reaction  
 IN Sakaguchi, Masakazu; Kawashima, Yoshinori  
 PA Toyo Ink Mfg. Co., Ltd., Japan  
 SO Jpn. Kokai Tokkyo Koho, 6 pp.  
 PI JP 04002958 A2 19920107 JP 1990-103657 19900419  
 AB The electrodes consist of a **composite** of a resin compd., a **conductive** resin compd., and optionally an org. metal complex compd. Preferably, a **conductive** resin compd. is manufd. by chem. oxidn. polymn. or electrolytic polymn. The **gas sensors** are useful for detection of **gas** components in exhaust **gases** and combustion waste **gases**, and have long life.

L22 ANSWER 447 OF 520 CA COPYRIGHT 2002 ACS  
 AN 111:42860 CA  
 TI Manufacture and use of electrically conductive polymers of five-membered heterocyclic compounds and anions of **tetrathiafulvalene** derivatives  
 IN Naarmann, Herbert; Muellen, Klaus; Wolf, Peter  
 PA BASF A.-G., Fed. Rep. Ger.  
 SO Ger. Offen., 7 pp.  
 PI DE 3728452 A1 19890309 DE 1987-3728452 19870826  
 AB The polymers are prepd. by electrochem. oxidative polymn. of 5-membered heterocyclic compd(s).. in the presence of conducting salts contg. anions of **tetrathiafulvalene** derivs. The polymers are used as **sensors** or battery electrodes. Derivs. of **tetrathiafulvalene** were synthesized. A soln. of 1 part pyrrole and 1 part NH<sub>4</sub> salt of 3,6-di- $\omega$ - sulfobenzyloxy-1,2,4,5-benzobis(11,11',12,12'-dibenzotetrathiafulvalene) in 100 parts MeCN was electropolymd. by using Pt electrodes. The obtained polymer film had an elec. cond. of 80 S/cm and showed a superior stability in a 1-wk storage in water to a ClO<sub>4</sub>--contg. **polypyrrole** film.

L22 ANSWER 457 OF 520 CA COPYRIGHT 2002 ACS

AN 110:127768 CA

TI Ion-selective electrode having a non-metal **sensing element**

IN Geist, Jill M.; Schapira, Thomas G.; Messner, Scott C.

PA Abbott Laboratories, USA

SO Eur. Pat. Appl., 13 pp.

PI EP 291904 A2 19881123 EP 1988-107817 19880516

US 4889612 A 19891226 US 1987-53446 19870522

PRAI US 1987-53446 19870522

AB This electrode comprises an elec. insulating substrate having a substantially planar 1st surface; a nonmetallic conductor on the 1st surface; means affixed to this 1st surface and coupled to the conductor, for sensing a potential located at a situs free of metalization; and an elec. insulating layer covering a portion of the conductor. The means for **sensing** comprises a nonmetallic, conductive **layer**, and an exposed ion-selective membrane covering the conductive layer. The elec. insulating layer comprises a 1st stratum affixed to the 1st surface, a 2nd stratum wherein at least a portion thereof is intersolubilized with the membrane layer, and a 3rd stratum covering the 2nd stratum. This electrode may also comprise a field-effect transistor, a nonmetallic conductive offset gate coupled to the field-effect transistor; an exposed ion-selective membrane layer covering the offset gate; and an elec. insulating layer covering at least a portion of the nonmetallic conductive gate. The nonmetallic conductive material may include **graphite** in a suitable supportive and binding matrix or may include a conductive polymer, such as **polyacetylene** and **polypyrrole** among others. In this way, metalization is not used on the surface of the device which contacts an analyte.

L22 ANSWER 466 OF 520 CA COPYRIGHT 2002 ACS

AN 109:84183 CA

TI Studies of semiconducting organic polymer-**graphite** composites from d.c. to microwave frequencies

AU Fourrier-Lamer, A.; Fizazi, A.; Belhadj-Tahar, N.; Fontanille, A.; Soum, A.

CS Lab. Dispos. Infrarouge Micro-Ondes, Univ. Paris, Paris, 75252, Fr.

SO Synth. Met. (1988), 24(1-2), 95-105

AB The semiconducting polymer composite samples are mixts. consisting of particles of **graphite** dispersed within a matrix of a doped substituted **polyacetylene**. The elec. impedance spectra are discussed in terms of inhomogeneity and intrinsic contributions. The frequency dependence of the a.c. **cond.** and permittivity was measured between 10 kHz and 12 GHz. The a.c. **cond.** is given by the power-law relation  $\sigma(\omega) \propto \omega^n$  with  $0 < n < 0.4$  at frequencies below 30 MHz;  $0.5 < n < 1$  at frequencies between 30 MHz and 2 GHz; and  $1 < n < 2$  at frequencies between 2 GHz and 8 GHz. A satn. occurs at approx. 8 GHz. Various theor. approaches are presented in order to support such behavior.

L22 ANSWER 470 OF 520 CA COPYRIGHT 2002 ACS

AN 108:194583 CA

TI Composite electrodes containing **conducting** polymers and lithium alloys

AU Maxfield, M.; Jow, T. R.; Gould, S.; Sewchok, M. G.; Shacklette, L. W.

CS Allied-Signal Inc., Morristown, NJ, 07960, USA

SO J. Electrochem. Soc. (1988), 135(2), 299-305

AB Attractive charge capacities, reversibility, and mech. stability were demonstrated at ambient temp. by **composite** film anodes of **polyacetylene** or poly(**p-phenylene**) with Li<sub>y</sub>Al or Li<sub>y</sub>Pb alloys. The alloys were dispersed in finely divided form throughout the **conducting** polymer matrix in a configuration that minimized alloy degrdn. processes assocd. with exfoliation, surface passivation, and inefficient Li diffusion.

L22 ANSWER 483 OF 520 CA COPYRIGHT 2002 ACS

AN 107:78760 CA

TI Plastics with electric **conductivity**

AU Banhegyi, Gyorgy

CS Hung.

SO Termeszt Vilaga (1987), 118(4), 168-71

AB The theory of elec. **cond.**, the **cond.** of continuous conjugated double-bond-contg. polymers (e.g., **polyacetylene**, polyphenyls), **conductive** polymer **composite** systems contg. **carbon black**, metal powders, etc., and practical applications (e.g., casing or housing to shield against background electromagnetic interferences for computers, devices for the chem. and mining industries) are discussed.

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